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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/932,943	08/21/2001	Gaku Minamihaba	04329.2622	5394

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Finnegan, Henderson, Farabow,
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Washington, DC 20005-3315

EXAMINER

LEE, HSIEN MING

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 09/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/932,943	Applicant(s) MINAMIHABA ET AL.	
	Examiner Hsien-Ming Lee	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 June 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 18-37 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 18-21, 23, 25-28, 30 and 32-34 is/are rejected.
- 7) ☒ Claim(s) 22, 24, 29, 31 and 35-37 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

HSIEN-MING LEE
PRIMARY EXAMINER

lie
9/14/2004

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Grounds of Rejections

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 18-21, 23, 25-28, 30 and 32-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishimura et al. (US 6,332,835) in view of Hattori (EP 1-123956) and Hudson (US 6,407,000).

In re claims 18-21, 23, 25, 30, 32, Nishimura et al. teach the claimed method of manufacturing a semiconductor device, which comprises:

- forming a wiring groove 103 on a surface of an insulating film 102 formed above a semiconductor substrate 100 (Fig.12D);
- depositing a conductive material film 104/105 (i.e. a wiring material film such as copper 105, col. 12, lines 34-37) on a surface of said insulating film 102 including an inner surface of said wiring groove 103 (Fig.12E), wherein the conductive material film 104/105 is a laminate film, wherein 104 is a barrier film TiN and Ti and 105 is a wiring film, copper; and
- subjecting said conductive material film 104/105 to a chemical mechanical polishing by making use of a slurry for chemical mechanical polishing, which contains polishing particles comprising first colloidal silica (i.e. SiO₂) particles whose primary

particles have a diameter ranging from 1 to 300 nm, and second colloidal silica particles whose primary particles have a diameter ranging from 3 nm to 1,000 nm (col. 8, lines 11-16), to remove said conductive material film 104/105 excluding a conductive material film portion which is buried in said wiring groove 103 (Fig.12F).

Nishimura et al. do not teach that the weight ratio of the first colloidal silica particles is in the range of 0.6 to 0.9 based on a total weight of said first and second colloidal silica particles.

Hattori, however, in an analogous art of using CMP for polishing metal material (paragraphs [0008], [0054]), teach utilizing a slurry comprising first colloidal silica particles whose primary particles have a diameter ranging from 5 to 100 nm, and second colloidal silica particles whose primary particles have a diameter ranging from 10 nm to 100 nm (paragraphs [0027], [0029]). Hattori further teach that the etching rate can be adjusted by adjusting composition of the slurry (paragraph [0056]), to avoid dishing (paragraph [0006]) and to achieve a good balance between chemical etching and mechanical polishing performance (paragraph [0112]).

In addition, Hudson in an analogous art of chemical mechanical polishing (CMP) process also teach utilizing a bi-modal slurry for planarizing a conductive layer, wherein the slurry comprising *first colloidal silica* particles whose primary particles have a diameter ranging from *0.010 μm (10 nm) to 0.050 μm (50 nm)*, and *second colloidal silica* whose primary particles have a diameter ranging approximately *0.070 ~0.400 μm (i.e. 70~400 nm)* (col. 7, lines 10-15), wherein the weight ratio of the first colloidal silica particles is in the range of *0.6 ~ 0.9* based on a total weight of said first and second silica colloidal particles, as illustrated in Fig. 4, wherein 290 represents the size distribution of the first colloidal silica particles and 280 represents the

Art Unit: 2823

size distribution of the second colloidal silica particles; and the ratio of 290 to 280 is within the range of 0.6~0.9.

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to optimize the slurry composition of Nishimura et al. in considerations of avoiding dishing and better polishing performance, as suggested by Hattori and Hudson, so that the weight ratio of the first colloidal silica particles is in as desired range, since by this manner it would improve the CMP performance.

In re claim 26, Nishimura et al. do not teach that said polishing particles are incorporated in said slurry at a ratio of 0.5 to 5% by weight.

Hattori, however, teaches that the content of colloidal silica is 0.05~20 % by weight (paragraph [0034]).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to optimize the colloidal silica percentage of the slurry in Nishimura et al. with a desired range, as suggested by Hattori, since by this manner it would achieve a good polishing performance by choosing the desired percentage of colloidal silicon in the slurry (paragraph [0034], Hattori).

In re claims 27 and 33, Hattori teaches that the slurry contains an oxidizing agent (paragraph [0048]) and an oxidation inhibitor, i.e. a base (paragraph [0050]), which would remedy the deficiency in Nishimura et al. Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to include the oxidizing agent and the oxidation inhibitor, as taught by Hattori, in Nishimura et al., since by this manner it would achieve a good polishing slurry composition.

Art Unit: 2823

In re claims 28 and 34, Hattori teaches that the slurry contains a surfactant (paragraph [0052]), which would remedy the deficiency in Nishimura et al. Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to include the surfactant, as taught by Hattori, in Nishimura et al., since by this manner it would achieve a good polishing performance (paragraph [0053], Hattori).

Allowable Subject Matter

3. Claims 22, 24, 29, 31 and 35-37 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

4. The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record neither teaches nor suggests that the slurry includes *third* particles formed of a material *different* from those of the first and second colloidal silica particles (claims 22 and 36); the surfactant is dodecyl benzene sulfonate (claims 29 and 35); and the third particles are colloidal alumina particles (claims 31 and 37).

Response to Arguments

5. Applicant's arguments have been fully considered but they are not persuasive.

Applicant's arguments mainly is on the ground that each individual reference does not teach the claimed limitations, as stated in claims 18 and 23, particular the limitations "first colloidal silica particles whose primary particles have a diameter ranging from 5 to 20 nm, and second colloidal silica particles whose primary particles have a diameter ranging from 20 to 50 nm, wherein the weight ratio of the first colloidal silica particles is in the range of 0.6 to 0.9 based on a total weight of said first and second colloidal silica particles."

In response to the arguments, Nishimura et al. teach all claimed limitations except that “the weight ratio of the first colloidal silica particles is in the range of 0.6 to 0.9 based on a total weight of said first and second colloidal silica particles.”

To remedy the above deficiency, Hattori and Hudson references are used. Hattori teaches the **same** claimed particle size ranges comprising first colloidal silica particles whose primary particles have a diameter ranging from 5 to 100 nm, and second colloidal silica particles whose primary particles have a diameter ranging from 10 to 100 nm. Hattori further suggests that the **weight ratio of the first and second silica particles can be optimized** to obtain a desired polishing rate so as to **avoid undesirable dishing** (paragraph [0006]) and to **achieve a good balance** between chemical etching and mechanical polishing performance (paragraph [0112]).

Therefore, one of the ordinary skill in the art would have been motivated to adjust the weight ratio of the first and second colloidal silica particles, as suggested by Hattori, while mixing the first and second colloidal silica particles of Nishimura et al to obtain a satisfactory CMP slurry, since by this manner it would achieve a good planarization and avoid dishing.

Hudson reference is used to further reinforce the obviousness of the combination of Nishimura et al. and Hattori. Hudson, in an analogous art of comprising similar first and second colloidal silica particles for CMP polishing, teaches the **same claimed weight ratio** of the first and second silica particles. In particular, Hudson demonstrated that the weight ratio of the first silica particles (290 in Fig.4) to the second silica particles (280 in Fig.4) is within the claimed range of 0.6~0.9.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on

combinations of references. With the combination of Nishimura et al., Hattori and Hudson, a *prima facie* case of obvious has been properly established and the rejections, as set forth in the previous Office Action, are deemed proper.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 571-272-1863. The examiner can normally be reached on Tuesday-Thursday (8:00 ~ 6:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 2823

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Hsien-Ming Lee
Primary Examiner
Art Unit 2823

September 14, 2004

HSIEN-MING LEE
PRIMARY EXAMINER

9/14/2004